

February 5, 1895.

Sir W. H. FLOWER, K.C.B., LL.D., F.R.S., President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1895.

The total number of registered additions to the Society's Menagerie during the month of January was 39, of which 29 were by presentation, 1 by birth, 3 by purchase, and 6 were received on deposit. The total number of departures during the same period, by death and removals, was 110.

Mr. Holding exhibited and made remarks on the skull of a Three-horned Stag, the head of a Four-horned Ram, and the gnawed horn of a Red Deer.

The following papers were read :—

1. Contribution to the Knowledge of the Breeding-habits of some Tree-Frogs (*Hylidæ*) of the Serra dos Orgãos, Rio de Janeiro, Brazil. By Dr. EMIL A. GOELDI, Director of the Museum of Natural History and Ethnography of Pará¹.

[Received January 1, 1895.]

1. *HYLA FABER*, Wied.

Hyla palmata, Burmeister; *H. maxima*, Reinhardt et Lütken.

The "Ferreiro" ("Smith") is of common occurrence in the Province Rio de Janeiro, more frequently still in the mountain regions of the Serra dos Orgãos than in the hot lowland. At Colonia Alpina, near Theresopolis, I could be sure to pick up three or four individuals in less than an hour in the evening, guided to their retreats by their singular voice. In fact this voice is one of the most characteristic sounds to be heard in tropical South America. Fancy the noise of a mallet, slowly and regularly beaten upon a copper plate, and you will have a pretty good idea of the concert, given generally by several individuals at the same time and with slight variations in tone and intensity.

When you approach the spot where the Tree-Frog sits, the sound ceases. But keep quiet, and it will be resumed after a few moments. You will discover the frog on a grass-stem, on a leaf of a low branch, or in the mud. Seize it quickly, for it is a most

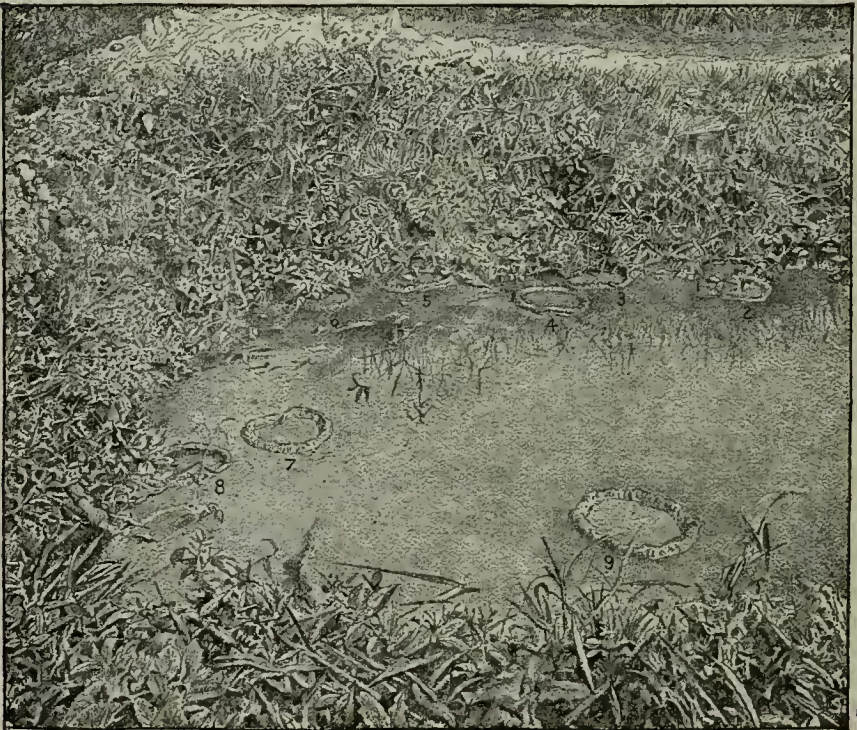
¹ Communicated by Mr. G. A. BOULENGER, F.R.S.

wonderful jumper, and it will utter a loud and shrill, most startling cry, somewhat similar to that of a wounded cat.

With the assistance of my cousin, Andreas Goeldi, a good observer and keen collector, I undertook, during numerous nights in all seasons, a thorough investigation of the batrachian life at Colonia Alpina, Theresopolis. As nothing is known of the habits of this most familiar and striking Tree-Frog¹, I think it will be interesting to describe some of the more essential features of its breeding-habits, as we had occasion to study them in 1893, and again in the beginning of 1894.

The appended figure, from a photograph taken from a portion of the pond in the middle of our large kitchen-garden, in February of last year, will help to complete my efforts to give a clear idea of the architectural skill of our frog. The nests are numbered in the figure.

Fig. 1.



Portion of a pond showing nurseries of *Hyla faber*.

Hyla faber makes, in the shallow water of the borders of ponds and similar localities, very regular pools of a circular form,

¹ In 1886 Mr. Boulenger published, as a supplement to an article "On the Oviposition in *Phyllomedusa iheringii*" (Ann. & Mag. Nat. Hist. ser. 5, xvii. p. 463), a very useful synoptic table, containing the facts known at that time respecting the mode in which tailless Batrachians deposit or protect their offspring. *Hyla faber* is not mentioned.

surrounded by a wall of mud—nurseries for the tadpoles. Nine of these nests or pools may be seen on the figure, and I shall describe how we witnessed their formation and subsequent use.

For the purpose of cleaning and deepening, the pond had been nearly emptied the year before and was kept in this state till the beginning of 1894, the water in the centre being no more than from 3 to 4 feet deep. In the first days of February we noticed some newly made walled pools every morning. We had to wait for full moonlight to make our observations.

On the night of the 18th February, between 9 and 11 o'clock, we approached the pond, occupied, as we could hear from a distance, by at least a dozen of the large Tree-Frogs. The moon was shining brightly, and much favoured our undertaking, but even under these circumstances we had to accustom our sight to discern the details in the marginal vegetation and the portions somewhat hidden in the shadow. By and by we discovered the "ferreiros," some at work, others drumming together on the walls of some pool or in the middle of the pond, sitting upon some floating object, such as water-plants. The vocalists, the moderately inflated subgular vocal sacs of which we could distinguish, were males.

We were posted on the side where the nests nos. 1 to 5 are to be seen. From a distance not greater than 2 to 3 feet we could survey, with all desirable distinctness, the rising of nest no. 3. On that place we first saw some slight movement in the water, produced by something stirring below the surface. We then soon saw a mass of mud rising to the surface carried by a Tree-Frog, of which no more than the two hands emerged. Diving again, after a moment's time, the frog brought up a second mass of mud, near the first. This was repeated many times, the result being the gradual erection of a circular wall. From time to time the builder's head and front part of body appeared suddenly with a load of mud on some opposite point. But what astonished us in the highest degree was the manner in which it used its hands for smoothing the inside of the mud wall, as would a mason with his trowel. And by examining the hands of *Hyla faber* it will readily be understood that they must act as excellent trowels, the terminal phalanges supporting very large expansions. This careful smoothening could be better observed as the wall got higher, until it reached about four inches, and the Tree-Frog was then obliged to get out of the water. The parapet of the wall receives the same careful smoothening, but the outside is neglected. The levelling of the bottom is obtained by the action of the lower surface (belly and throat principally) together with that of the hands. We can well compare the aspect of the pool to the crater of an extinct volcano or a large porringer filled with water, measuring nearly a foot in diameter and generally of a very regular circular form.

Now we have to record another observation, made with the most positive certainty, viz., that the male frog is present during

the erection of the nest or pool, in a perfectly passive manner however, that is sitting on the back of the female. However, his erotic ardour is by no means such a frantic one as I have often witnessed in certain European frogs and toads, for, if frightened, the male jumps off and dives down, though not very far. Some time after you will see him emerge again at a few feet distance, and, if all danger seems past, he will suddenly climb up the wall of his home and resume his former position. The building operations are performed in the most absolute silence. The croakers around are all males clamouring for a mate.

These Tree-Frogs work exclusively during the night; in the daytime no sign of Batrachian life can be detected about the pools.

Pool no. 3 was finished in two nights (18th and 19th February). On the 20th, in the morning, it was filled with eggs. But on other pools we observed that the eggs sometimes appear only 4 or 5 days after their completion. From 4 to 5 days is necessary for the young tadpoles to leave the eggs; various circumstances, especially the weather, cause sensible differences. Heavy rainfall may destroy the pools, rapidly reducing the height of the walls and thus prematurely releasing part of the tadpoles. But a good number of them will be left on the bottom, and will abandon their nursery only in due time. The parents keep during the day in the neighbourhood of their pools, but are very difficult to discover; sometimes we detected the female hidden at the bottom of the pool.

Eggs and tadpoles were carefully studied, observed, and compared, in order to get a positive and sure basis for an accurate determination and to avoid any chance of confusion. My cousin undertook to rear simultaneously tadpoles in unlimited freedom and others kept in tubs, some specimens being put into alcohol from time to time, carefully noting the results. Details about dimensions, coloration, and changes with growth, I reserve for a future note. I may, however, anticipate this by stating that the tadpoles of *Hyla faber*, though rapidly attaining a large size, as may be expected of one of the largest species of Tree-Frogs, preserve for a long time the larval tail, which disappears only when the young frog has reached nearly 3 cm. in length. A young "ferreiro" of these dimensions, which had just lost its tail, was sent by me some months ago to Mr. Boulenger for the British Museum collection.

Having seen several hundreds of adult individuals alive, I may be allowed to say a few words as to the external features of *Hyla faber*. To define what is in fact to be considered as the normal coloration is by no means an easy task, as all the Brazilian Tree-Frogs I have yet observed modify their colours wonderfully according to the surroundings and especially the different degrees of light. Put one of these *Hyla faber* near the window, in a well-illuminated place, it will rapidly turn pale; examine the same individual at night, and the longitudinal median stripe of the

back, as well as the transverse dark bars of the hind legs, are very distinct.

In the literature at my disposal I can find only one figure of *Hyla faber*—that given by Prince Maximilian¹, underside and lateral view. The figure is tolerable, and easily recognizable. But concerning the underside I must remark that *Hyla faber* exhibits a very beautiful orange tinge, and not the whitish colour (due to spirit preservation) shown in the figure.

Hyla faber is easily kept alive for a considerable time, even without special care; it is a tolerably hardy Tree-Frog, and could be, I am convinced, transported quite well, alive, to England, especially during the European summer.

I feel really happy to have succeeded in clearing up the natural history of one of the most remarkable forms of tailless Batrachians in South America, a Tree-Frog which will ever attract the attention and curiosity of all lovers of nature. How many times have I not been questioned as to the scientific name of this "ferreiro," both by Brazilians and foreigners; how often have they not been alluded to in the books of travellers!

I find that Hensel observed in Rio Grande do Sul pools similar to those above described, which he attributes to *Cystignathus ocellatus*. The description makes me almost sure that the pools seen by Hensel and by me had the same origin, and that the author was wrong in his supposition. Hensel was a good naturalist, but in this case I maintain most positively that, though *Cystignathus ocellatus* is very often to be found together with *Hyla faber* in the same locality and pond, the nursery-pools in the Serra dos Orgãos are constructions due to *Hyla faber*. I have all the more reason to maintain this assertion against the authority of the distinguished German naturalist, as I myself, prior to 1893, attributed the pools to *Cystignathus*. Really the error is easy to understand, as during the day the most frequent Batrachian to be seen in these localities is the last-named big and well-known frog, whilst *Hyla faber* works at the pools only during the night, keeping hidden during the day. This mistake, as I think, has been repeated by others on Hensel's authority (see Mr. Boulenger's remarks in connection with Dr. von Ihering's note on the oviposition of *Phyllomedusa*, Ann. & Mag. N. H. ser. 5, xvii. p. 464).

2. *HYLA POLYTENIA*, Cope.

Hyla rubicundula, Günther, nec Reinhardt et Lütken.

The charming little Tree-Frog, of which an excellent figure was given by Dr. Günther in 1868², is very frequent in the Serra dos Orgãos. At Colônia Alpina half a dozen or more can

¹ 'Abbildungen zur Naturgeschichte Brasiliens,' tab. 49.

² "First Account of Species of Tailless Batrachians added to the Collection of the British Museum," P. Z. S. 1868, pl. xl. fig. 3.

be collected on the same nocturnal excursion. The voice is an acute "gr-gr-gr . . .," tolerably melodious, resembling somewhat the chirping of certain small birds, the wren for instance.

I have likewise some observations on the life-history of this Batrachian. But I shall be brief on this subject, limiting myself to essential points. *Hyla polytania* makes no nursery-pools for its offspring. It deposits its eggs in free lumpy masses on water-plants. I have a photograph taken by my cousin in the beginning of this year, showing such masses attached to a branch of a species of *Tradescantia*, taken from the margin of the same pond as mentioned above. My cousin informs me that the tadpoles have a remarkably slow development, and supposes that the larval condition lasts a whole year.

3. *HYLA GOELDII*, Boulenger.

At Colonia Alpina we discovered in the water which, as is well known, is present in the central cup of certain *Bromeliaceæ* (*Bilbergia*, &c.) another pretty Tree-Frog. I could not determine it, even with the help of Mr. Boulenger's 'Catalogue' (published in 1882), though it is a very distinct and characteristic species. Alive it is of a greenish-grey colour, with a violin-shaped dark figure on the anterior half of the dorsal median line and large transverse bars on the hind legs.

The first specimen found was a female, carrying on her back a lumpy mass of about 10 large, globular, whitish eggs. This fact was sufficient to attract my attention, guessing that I was on the track of a similar case as observed formerly by Bello, Gundlach, and Bavay on the "Coqui" (*Hylodes martinicensis*) of the West Indies. The specimen was put in a large glass, fitted up rapidly to a tolerably habitable vivarium. For a few days the egg-mass remained attached to the mother's back. But suddenly it fell away and simultaneously I saw in the glass some small, nearly black-coloured frogs, all provided with the anterior and posterior legs, together with a larval tail of medium or rather small size. These young exhibited, from the first moment, a quite unexpected agility and independence, jumping about perfectly well and showing marked preference to stick to the glass walls and to the surfaces of the stones rather than to remain in the water. Part of them I put in a tube with alcohol, which I sent to Mr. Boulenger, together with the mother, while a second, larger specimen, obtained some days afterwards and found in a dry bamboo, very near the locality of the mentioned *Bromelia*, went to London, *viâ* Paris, in order to enable my friend Dr. Tronessart to study *in situ* some psoric Acarids (larvæ of a species of *Trombidium*), visible as crimson points on the abdominal side. The discovery of this second specimen was due to the strong sibilance¹ emitted every night just

¹ In 1886 (Ann. & Mag. N. H. ser. 5, xvii. p. 462) Dr. H. von Ihering wrote about the voice of *Phyllomedusa iheringii*:—"Their moderately loud voice resembles somewhat the sound produced by running the finger-nail along a thick hair-comb."

below our bed-room; the voice is much louder than that of *Hyla polytenia*. I had hoped to succeed in bringing up the remaining part of the young Tree-Frogs. But they died one after the other in a few days, without my being able to assign any cause for this mortality. Thus my study unfortunately soon came to an end.

The first author who, as I believe, noted that the Bromelia-water often contains larvæ of Brazilian Batrachians was Prince Maximilian. Thus he writes about his *Hyla luteola*:—"Er lebt auf den Gesträuchen, besonders auf den stiefen Blättern der Bromelien, wo er auch in dem daselbst zurückbleibenden Regenwasser seine Brut anbringt." But he tells us nothing about the abridged direct development. This discovery is due, I find by reference to what literature¹ is accessible to me, to Dr. Bello in Puertorico. Peters, of Berlin, states, in 1876², that Dr. Gundlach re-discovered the fact, having made thorough observations on the Antillean "Coqui" (*Hylodes martinicensis*). Unfortunately I have nothing to add to these statements, now already 20 years old, beyond the circumstance that not only in the Antillean region, but also in the South-American continent, there exist Batrachians which leave

Fig. 2.



Hyla goeldi, with egg-mass on back. ('Nature,' xix. p. 463.)

the egg in a highly developed condition, provided with the extremities and the other requisites for terrestrial life. I find, moreover, I cannot lay claim to the first discovery of the breeding-habits of the above mentioned *Hyla*. On looking through some old papers left by Dr. Fritz Müller, I recently came across some notes and a photograph, which evidently refer to the same facts. Mr. Boulenger, to whom I submitted these documents, informs me that Dr. Fritz Müller's observations, communicated by him to Darwin, were published in 1879 in the journal 'Nature'

¹ See, on this subject especially, F. K. Knauer, 'Naturgeschichte der Lurche' (Wien, 1878), p. 83 seq.; and Mr. Boulenger, Ann. & Mag. N. H. ser. 5, xvii. p. 464.

² "Ueber eine von Krug und Gundlach auf der Insel Puertorico gemachte Sammlung von Amphibien, sowie über die Entwicklung eines Batrachiers, *Hylodes martinicensis*." Monatsb. d. k. Akad. Wissensch. Berlin, November 1876. (Quoted from Knauer.)

(vol. xix. p. 462), with a figure, which is now reproduced, by kind permission of the proprietors, together with the original note:—"If I remember well I have already told you of the curious fauna which is to be met with between the leaves of our *Bromelice*. Lately I found in a large *Bromelia* a little frog (*Hylodes?*) bearing its eggs on the back. The eggs were very large, so that nine of them covered the whole back, from the shoulders to the hind end, as you will see in the photograph (see p. 95) accompanying this letter (the little animal was so restless that only after many fruitless trials a tolerable photograph could be obtained). The tadpoles, on emerging from the eggs, were already provided with hind-legs; and one of them lived with me about a fortnight, when the fore-legs also had made their appearance. During this time I saw no external branchiæ, nor did I find any opening which might lead to internal branchiæ."

Mr. Boulenger, to whom I am indebted for continued help and advice in my attempts to work at Brazilian herpetology, took great interest in the present Tree-Frog, which he has kindly named after me, and described in the 'Proceedings' of this Society for 1894 (p. 645).

4. *HYLA NEBULOSA*, Spix.

Hyla luteola, Günther et Burmeister.

In the sheaths of old and decaying leaves of banana-trees (*Musa*) we have often found another Tree-Frog, so often that we have designated it as the Banana-Frog. It is generally brownish above, turning to yellowish in the daylight; below yellow, with vertical bluish bars on the sides of the thighs. I identify it, not without some hesitation, with *H. nebulosa*, Spix, as defined by Mr. Boulenger, p. 397 of his 'Catalogue.'

I have a few words to say on this Tree-Frog, as it presents a fourth mode of oviposition. It glues its lumps of eggs on the edges and on the inside of withered banana-leaves, where, even during the hot hours of the day, sufficient coolness and moisture are preserved.

These lumps are enveloped in a frothy, whitish substance, comparable to the scum formed by certain *Cicadidæ*, so frequently met with in European meadows. Sometimes the tailed larvæ are seen wriggling in this frothy mass. *If they be put into fresh water all will die in a few hours.* We have many times repeated this experiment, and are convinced that superabundance of water is directly noxious to them. There can be no other explanation but that a quantity of water, covering entirely the lump, intercepts the respiration.

Herpetologists will find a striking resemblance between my observations on this "Banana-Frog" and those made by Dr. H. von Ihering on the oviposition of *Phyllomedusa iheringi*¹, as described

¹ I have found several specimens of a species, not yet identified with certitude, of *Phyllomedusa* in the Serra dos Orgãos, but I have not been able to observe the life-history of this interesting and magnificent Tree-Frog.

